

CONTENTS

The Reciprocal Effects of Nitrogen, Phosphorus, and Potassium as Related to the Absorption of these Elements by Plants. WALTER THOMAS.....	1
Studies on the Dispersion Procedure Used in the Hydrometer Method for Making Mechanical Analysis of Soils. GEORGE JOHN BOUYOUCOS.....	21
Further Studies on the Relationships Between the Fine Material of Soils and Their Physical Characteristics. GEORGE JOHN BOUYOUCOS.....	27
The Laws of Soil Colloidal Behavior: VII. Proteins and Proteinated Complexes. SANTE MATTSON.....	41
Electrokinetics and Base-Exchange Capacity of Some Inorganic Colloids. N. H. PARBERY AND SANTE MATTSON.....	75
Equilibria of the Base-Exchange Reactions of Bentonites, Permutites, Soil Colloids, and Zeolites. ALBERT P. VANSELOW.....	95
Dehydration, Soil Acidity, and Exchangeable Bases. H. G. COLES AND C. G. T. MORISON.....	115
Studies on the Blue Colorimetric Method for the Determination of Phosphorus. H. D. CHAPMAN.....	125
On the Origin of the Uronic Acids in the Humus of Soil, Peat, and Composts. SELMAN A. WAKSMAN AND H. W. REUSZER.....	135
The Effect of Temperature upon Nitrogen Fixation by Azotobacter. ROBERT A. GREENE.....	153
Sorption Phenomena in Soils and in Silica Gels. ELIZABETH D. DE PARAVICINI.....	163
An Improved Method of Measuring Soil Color. CHARLES F. SHAW.....	183
Factors Affecting the Amount of Electrodialyzable Ions Liberated from Some Soils. AASULV LÖDDESÖL.....	187
The Determination of Nitrates in Soils Containing Soluble Organic Matter. M. J. PLICE.....	213
Soil Profile Studies: IV Morphological and Chemical Evidence of Podzolization. J. S. JOFFE.....	217
Book Reviews.....	239
A New Type of Hydrometer for the Mechanical Analysis of Soils. AMAR NATH PURI.....	241
Replaceable Bases in the Soils of Southeastern Minnesota and the Effect of Lime upon Them. C. O. ROST AND JEAN M. ZETTERBERG.....	249
Effects of Stable Manure and Certain Fertilizers on the Microbiological Activities in Virgin Peat. S. C. VANDECAVEYE.....	279
The Laws of Soil Colloidal Behavior: VIII: Forms and Functions of Water. SANTE MATTSON.....	301
A Quantitative Study of the Microörganic Population of a Hemlock and a Deciduous Forest Soil. MARY JO COBB.....	325
The Diurnal and Seasonal Changes in the Sugar Content of the Sap and Tissue of Potato Plants as Affected by Soil Fertilization. RALPH C. COLE.....	347
The Use of the Moisture Equivalent in the Textural Classification of Soils. G. B. BODMAN AND A. J. MAHMUD.....	363
Investigations Concerning Separation of Similarly Charged Ions from Soils by Electro-dialysis. AASULV LÖDDESÖL.....	375

Interaction Between Ammonia and Soils as a New Method of Determining the State of Saturation and pH Values of Soils. AMAR NATH PURI.....	397
A New Method of Determining Clay Content of Soils by Moisture Absorption at 70 Per Cent Humidity. AMAR NATH PURI.....	405
Iron in Relation to the Stimulation of Growth by Humic Acid. DEAN BURK, HANS LINEWEAVER, AND C. KENNETH HORNER.....	413
The Physiological Nature of Humic Acid Stimulation of Azotobacter Growth. DEAN BURK, HANS LINEWEAVER, AND C. KENNETH HORNER.....	455
Book Reviews.....	489

ILLUSTRATIONS

PLATES

FURTHER STUDIES ON THE RELATIONSHIPS BETWEEN THE FINE MATERIAL OF SOILS AND THEIR PHYSICAL CHARACTERISTICS

Plate 1. Machine Used to Disperse Soils in Determining the Flowing Point of Soils.....	39
--	----

AN IMPROVED METHOD OF MEASURING SOIL COLOR

Plate 1. The Soil Colorimeter.....	185
Fig. 1. Colorimeter at rest with soil disc mounted in place.....	185
2. Colorimeter rotating.....	185

FACTORS AFFECTING THE AMOUNT OF ELECTRODIALYZABLE IONS LIBERATED FROM SOME SOILS

Plate 1. Apparatus Used in Experiments.....	211
Fig. 1. The author's electrodialysis apparatus.....	211
2. Mechanical dispersion and stirring equipments.....	211

SOIL PROFILE STUDIES: IV. MORPHOLOGICAL AND CHEMICAL EVIDENCE OF PODZOLIZATION

Plate 1. A Typical Loam Podzol Profile.....	237
---	-----

THE LAWS OF SOIL COLLOIDAL BEHAVIOR: VIII. FORMS AND FUNCTIONS OF WATER

Plate 1. Influence of Na and Ca upon the Swelling of the Sharkey Soil Colloid.....	323
--	-----

INVESTIGATIONS CONCERNING SEPARATION OF SIMILARLY CHARGED IONS FROM SOILS BY ELECTRODIALYSIS

Plate 1. Five-compartment Electrodialysis Apparatus.....	395
--	-----

IRON IN RELATION TO THE STIMULATION OF GROWTH BY HUMIC ACID

Plate 1. Warburg Micro-respiration Apparatus for Measuring Oxygen Consumption and Growth.....	453
---	-----

TEXT-FIGURES

THE RECIPROCAL EFFECTS OF NITROGEN, PHOSPHORUS, AND POTASSIUM AS RELATED TO THE ABSORPTION OF THESE ELEMENTS BY PLANTS

Fig. 1. Relation of Yield to Water Content of Soil.....	2
2. The Course of the Absorption of Nitrogen, Phosphorus, and Potassium by <i>Pyrus malus</i> L. as Determined by the Periodic Analysis of the Current and Season's Branch Growth.....	6
3. The Course of the Absorption of Nitrogen, Phosphorus, and Potassium by <i>Vitis vitifera</i> as Determined by the Periodic Analysis of the Leaves.....	7
4. The Course of the Absorption of Nitrogen, Phosphorus, and Potassium by <i>Hordeum sativum</i> as Determined by the Periodic Analysis of Whole Plants.....	8
5. Relation of the Length of the Roots of Wheat Seedlings Growing in Solutions of 0.12 Mol. NaCl (Solution S) and of 0.164 Mol. CaCl ₂ (Solution S ₁) in the Proportions Indicated to the Dissociation Curves of the Separate Salts Determined at Dilutions Corresponding to the Proportions at Which Each Salt Is Present in the Mixture.....	13

THE LAWS OF SOIL COLLOIDAL BEHAVIOR: VII. PROTEINS AND PROTEINATED COMPLEXES

Fig. 11A. Cataphoresis of Albumin, Casein, Edestin, and Gelatin at Different pH Values, Adjusted by NaOH and HCl.....	44
11B. The Buffer Capacity of Edestin, Albumin, Casein, and Gelatin in HCl Solution.....	44
12. Cataphoresis and Isoelectric Points of a Series of Al-"Caseinates" and of Casein-"Humates".....	49
13. The Isoelectric Points of Casein and Edestin and Some of Their Compounds, Compared.....	57
14. Relation Between Composition and Isoelectric pH of Al-"Caseinate" and Casein-"Humate".....	60
15. Aluminum "Hydroxide" Combines with (Adsorbs) More SO_4 than Al-albuminate (Left); Humic Acid Adsorbs More Ca than Albumin "Humate" (Right).....	62

EQUILIBRIA OF THE BASE-EXCHANGE REACTIONS OF BENTONITES, PERMUTITES, SOIL COLLOIDS AND ZEOLITES

Fig. 1. Equilibria in the Sodium-Potassium Exchange Reaction of the Various Aluminosilicates.....	105
2. Equilibria in the Calcium-ammonium Exchange Reactions of Bentonite 7 and Soil Colloid 431.....	108

STUDIES ON THE BLUE COLORIMETRIC METHOD FOR THE DETERMINATION OF PHOSPHORUS

Fig. 1. Effect of Varying Amounts of $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ on Total Color Produced.....	127
---	-----

THE EFFECT OF TEMPERATURE UPON NITROGEN FIXATION BY AZOTOBACTER

Fig. 1. The Effect of Temperature upon Nitrogen Fixation by Azotobacter.....	156
--	-----

SORPTION PHENOMENA IN SOILS AND IN SILICA GELS

Fig. 1. Rods of Borosilicate Fastened Across the Corners of the Electrodes.....	164
2. Arrangement of Conductivity Cells.....	164
3. (B-A)' Concentration Curves for Salts Added to Soil II.....	168
4. Sorption Values for a Natural Clay Subsoil (Soil II).....	169
5. Conductivity Results Obtained with Leached Soils.....	170
6. Increases in Conductivity Due to Hydrion Exchange.....	171
7. Sorption Values for the "Hydrogen" Soil.....	172
8. (B-A) and C Curves for Gels.....	174
9. Sorption for Gels I and II Plotted Against Initial Concentration of Added Salt....	179

FACTORS AFFECTING THE AMOUNT OF ELECTRODIALYZABLE IONS LIBERATED FROM SOME SOILS

Fig. 1. Relation Between Cation Liberation and Amperage.....	206
--	-----

SOIL PROFILE STUDIES: IV. MORPHOLOGICAL AND CHEMICAL EVIDENCE OF PODZOLIZATION

Fig. 1. Base Exchange Capacity of Sassafras, Penn, Chester, and Washington Soils, and of a Loam Podzol.....	228
2. Sesquioxides of Sassafras, Penn, Chester, and Washington Soils.....	232
3. SiO_2 of Sassafras, Penn, Chester, and Washington Soils.....	232
4. Unsaturation of Sassafras, Penn, Chester, and Washington Soils.....	233

A NEW TYPE OF HYDROMETER FOR THE MECHANICAL ANALYSIS OF SOILS

Fig. 1. Curves Showing Density Gradient in a Sedimenting Column at Different Intervals of Time.....	242
2. Diagram of the New Type of Hydrometer and Reading Device.....	243

REPLACEABLE BASES IN THE SOILS OF SOUTHEASTERN MINNESOTA AND THE EFFECT OF LIME UPON THEM

- Fig. 1. Map of Southeastern Minnesota Showing the Location of the 28 Fields from Which Soil Samples were Studied..... 252

EFFECTS OF STABLE MANURE AND CERTAIN FERTILIZERS ON THE MICROBIOLOGICAL ACTIVITIES IN VIRGIN PEAT

- Fig. 1. Bacteria, Fungi, and Actinomyces in Peat Treated with Unsterilized Manure, Sterilized Manure, and Wheat Straw in Addition to Superphosphate..... 288
2. Carbon Dioxide Evolution and Nitrification in Palouse Silt Loam and Woody-sedge Peat Treated with Wheat Straw and Sodium Nitrate..... 295
3. Bacteria, Fungi, and Actinomyces in Palouse Silt Loam and Woody-sedge Peat Treated with Wheat Straw and Sodium Nitrate..... 296

THE LAWS OF SOIL COLLOIDAL BEHAVIOR: VIII. FORMS AND FUNCTIONS OF WATER

- Fig. 16. The Donnan Distribution of Ions Between the Micellar and the Outside Solutions..... 307
17. The Swelling of Bentonite in Relation to the Nature of the Exchangeable Cations..... 309
18. The Relation Between Swelling, Composition, and Exchange Capacity..... 310
19. The Suppression of the Swelling of Na-saturated Sharkey Colloid by Various Electrolytes..... 312
20. The Relation Between the Volume of Water (w) Per Gram Bentonite..... 315
21. The Schematic Representation of the Increase in the Concentration of the Ions Dissociated by the Colloid (z) and the Decrease in the Concentration of the Free Ions of the Solution (y), in the Direction of the Surface of the Particles..... 319

THE DIURNAL AND SEASONAL CHANGES IN THE SUGAR CONTENT OF THE SAP AND TISSUE OF POTATO PLANTS AS AFFECTED BY SOIL FERTILIZATION

- Fig. 1. A Comparison of the Munson and Walker and the Quisumbing and Thomas Tables for Calculating the Quantity of Sugar from the Amount of Copper Reduced..... 352
2. Results of Fertilizer Treatment on Per Cent of Glucose in Samples Taken July 23, 1930..... 354
3. Results of Fertilizer Treatment on Per Cent of Sucrose in Samples Taken July 23, 1930..... 355

THE USE OF THE MOISTURE EQUIVALENT IN THE TEXTURAL CLASSIFICATION OF SOILS

- Fig. 1. Calculated and Observed Moisture Equivalents for Four Soil Combinations..... 368
2. Diagram Illustrating Relation Between Moisture Equivalent and Mechanical Composition..... 370
3. Soil Class-Moisture Equivalent Diagram Based on Davis' and Bennett's Triangle and Smith's Moisture Equivalent Values for Soil Separates..... 371

A NEW METHOD OF DETERMINING CLAY CONTENT OF SOILS BY MOISTURE ABSORPTION AT PER CENT HUMIDITY

- Fig. 1. Typical Vapor Pressure Curves of Two Normal Soils (P. C. 8 and 11), a Highly Acid Soil (P. C. 6), and a Highly Alkaline Soil (P. C. 60)..... 406

IRON IN RELATION TO THE STIMULATION OF GROWTH BY HUMIC ACID

Fig. 1. Diagram of Manometer and Vessels Employed in Measuring Oxygen Consumption and Growth.....	417
2. The Humic Acid Ratio as a Function of Concentration of Iron Supplied by Natural Humic Acids.....	438
3. The Humic Acid Ratio as a Function of Concentration of Iron Supplied by Synthetic Humic Acids.....	439

THE PHYSIOLOGICAL NATURE OF HUMIC ACID STIMULATION OF AZOTOBACTER GROWTH

Fig. 1. The Differential Influence of Concentration of Natural Humic Acid upon the Humic Acid Velocity Constant Ratio (Warburg Technique).....	457
2. The Integral Influence of Concentration of Natural Humic Acid upon the Humic Acid Ratio in Experiments of Very Long Duration (Erlenmeyer Technique)....	458
3. Parts Per Million of Humic Acid.....	460
3A. Parts Per Million of Humic Acid.....	460
3B. Parts Per Million of Iron.....	460
4. Stimulation as a Function of Growth Velocity.....	463
5. The Influence of Temperature upon the Humic Acid-Velocity Constant Ratio (Warburg Technique).....	467
6. The Sharply Defined Onset of Humic Acid Stimulation with Different Lengths of Induction Period, Humic Acids, Temperatures, and Nitrogen Sources (Warburg Technique).....	472
7. Humic Acid Stimulation as a Function of Time and Concentration of Humic Acid (Warburg Technique).....	474
8. The Induction Period as a Function of Moment of Addition (Warburg Technique).....	475

